Redbox RB-DD4
4 Channel Digital Audio
Delay Synchroniser
User Handbook

SONIFEX
Redbox

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This handbook is for use with the following product:

Redbox RB-DD4 4 Channel Digital Audio Delay Synchroniser

SONIFEX

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Warranty

Warranty and Liability

Important: the purchaser is advised to read this clause

a. The Company agrees to repair or (at its discretion) replace Goods which are found to be defective (fair wear and tear excepted) and which are returned to the Company within 12 months of the date of despatch provided that each of the following are satisfied:

    i. notification of any defect is given to the Company immediately upon its becoming apparent to the Purchaser;

    ii. the Goods have only been operated under normal operating conditions and have only been subject to normal use (and in particular the Goods must have been correctly connected and must not have been subject to high voltage or to ionising radiation and must not have been used contrary to the Company's technical recommendations);

    iii. the Goods are returned to the Company's premises at the Purchaser's expense;

    iv. any Goods or parts of Goods replaced shall become the property of the Company;

    v. no work whatsoever (other than normal and proper maintenance) has been carried out to the Goods or any part of the Goods without the Company's prior written consent;

    vi. the defect has not arisen from a design made, furnished or specified by the Purchaser;

    vii. the Goods have been assembled or incorporated into other goods only in accordance with any instructions issued by the Company;

    viii. the defect has not arisen from a design modified by the Purchaser;

    ix. the defect has not arisen from an item manufactured by a person other than the Company.

In respect of any item manufactured by a person other than the Company, the Purchaser shall only be entitled to the benefit of any warranty or guarantee provided by such manufacturer to the Company.

b. In respect of computer software supplied by the Company the Company does not warrant that the use of the software will be uninterrupted or error free.

c. The Company accepts liability:
    i.   for death or personal injury to the extent that it results from the negligence of the Company, its employees (whilst in the course of their employment) or its agents (in the course of the agency);
    ii. for any breach by the Company of any statutory undertaking as to title, quiet possession and freedom from encumbrance.

d. Subject to conditions (a) and (c) from the time of despatch of the Goods from the Company's premises the Purchaser shall be responsible for any defect in the Goods or loss, damage, nuisance or interference whatsoever consequential economic or otherwise or wastage of material resulting from or caused by or to the Goods. In particular the Company shall not be liable for any loss of profits or other economic losses. The Company accordingly excludes all liability for the same.

e. At the request and expense of the Purchaser the Company will test the Goods to ascertain performance levels and provide a report of the results of that test. The report will be accurate at the time of the test, to the best of the belief and knowledge of the Company, and the Company accepts no liability in respect of its accuracy beyond that set out in Condition (a).

f. Subject to Condition (e) no representation, condition, warranty or other term, express or implied (by statute or otherwise) is given by the Company that the Goods are of any particular quality or standard or will enable the Purchaser to attain any particular performance or result, or will be suitable for any particular purpose or use under specific conditions or will provide any particular capacity, notwithstanding that the requirement for such performance, result or capacity or that such particular purpose or conditions may have been known (or ought to have been known) to the Company, its employees or agents.

g. i.   To the extent that the Company is held legally liable to the Purchaser for any single breach of contract, tort, representation or other act or default, the Company's liability for the same shall not exceed the Price of the Goods.
    ii. The restriction of liability in Condition (g)(i) shall not apply to any liability accepted by the Seller in Condition (c).
    iii. Where the Goods are sold under a consumer transaction (as defined by the Consumer Transactions (Restrictions on Statements) Order 1976) the statutory rights of the Purchaser are not affected by these Conditions of Sale.

Unpacking the RB-DD4

The RB-DD4 is shipped with the following equipment. Please check your packaging to ensure that you have all of the items below. If anything is missing, please contact the supplier of your equipment immediately.

Item	Quantity RB-DD4
RB-DD4	1
IEC Mains lead fitted with moulded mains plug	1
Handbook and warranty card	1

Fig A: Packing List

Each RB-DD4 is shipped in protective packaging and should be inspected for damage before use. Where an item is found to have transit damage, notify the carrier immediately with all the relevant details of the shipment. Packing materials should be kept for inspection and also for if the product needs to be returned.

Returning the Warranty Card

In order to register the date of purchase so that we can keep you informed of any design improvements or modifications, it is important to complete the warranty registration document that is enclosed and return it to Sonifex Ltd in the UK.

For your own records you should write down the serial number (which can be found on the rear of the RB-DD4).

Serial Number	………………………………………

Safety Information

Safety of Mains Operated Equipment

CE This equipment has been designed to meet the safety regulations currently advised in the country of purchase and it conforms to the safety regulations specified by use of the CE Mark.

Warning : There are no user serviceable parts inside the equipment. If you should ever need to look inside the unit, always disconnect the mains supply before removing the equipment covers.

Voltage Setting Checks

Ensure that the machine operating voltage is correct for your mains power supply by checking the box in which your Redbox was supplied. The voltage is shown on the box label. The available voltage settings are 115V, or 230V. Please note that all Redboxes are either switchable between 115V and 230V, or have a universal power supply.

Fuse Rating

The RB-DD4 is supplied with a single fuse in the live conducting path of the mains power input. For reasons of safety it is important that the correct rating and type of fuse is used. Incorrectly rated fuses could present a possible fire hazard, under equipment fault conditions. The fuse rating for the RB-DD4 is:

230 or 115 V operation - 2A   5 x 20mm SB

The active fuse is fitted on the outside rear panel of the unit.

Power Cable and Connection

An IEC power connector is supplied with the RB-DD4 which has a moulded plug attached – this is a legal requirement. If no moulded plug has been supplied with your RB-DD4, please contact your supplier, because an IEC connector is always supplied from the Sonifex factory.

If for any reason, you need to use the RB-DD4 with a different power cable, you should use the following wiring guidelines.

Wire Colour	Connection
Green, or green and yellow	Earth (E)
Blue, or Black	Neutral (N)
Brown, or Red	Live (L)

Fig B: Power Connections

Connect the equipment in accordance with the connection details and before applying power to the unit, check that the machine has the correct operating voltage for your mains power supply.

Important Note : The terminal marked on the rear panel must be earthed.

Ordering the Correct Mains Lead

When ordering a Redbox from Sonifex, it is helpful if you can specify your required operating voltage and mains lead. After the product code add:

UK, for 230V, UK 3 pin to IEC lead	
EC, for 230V, European Schuko 2 pin to IEC lead	
US, for 115V, 3 pin to IEC lead	
AU for 230V, Australasian 3 pin to IEC lead	

Fig C: Mains Lead Table

E.g. order RB-DD4 UK for a UK IEC lead to be supplied.

SAFETY INFORMATION

Installation Information

Atmosphere

The units should be installed in an area that is not subject to excessive temperature variation (<0°C, >50°C), moisture, dust or vibration.

Electromagnetic Radiation

The cover is connected to earth by means of the fixing screws. It is essential to maintain this earth ground connection to ensure a safe operating environment and provide electromagnetic shielding.

Fitting Redboxes

Redboxes can be fixed to the underside of a mixing desk, or other surfaces using 4.2mm holes in the sides and fixed with 2 x M4 screws or 2 x No. 6 countersink wood screws.

They can also be rack-mounted, with either the front, or rear of the Redbox positioned at the front of the rack:

Rear Mounting The RB-DD4: The **RB-RK3** 1U rear panel rack kit can be used for large Redboxes such as the RB-DD4.

Fig D: RB-RK3 Large Redbox Rear Rack-mount Kit

Note: When fitting the rear-mounting rack-kits, a notch has been left on the inside of the right-hand rack-piece for the mains cable to pass through. Make sure that the mains cable has been put through the notch before attaching the right hand rack-piece.

Installing the Optional Video Sync Boards

There are 2 optional video sync boards which can be used to synchronise the outputs of the RB-DD4 to a 48kHz sample rate from an analogue or digital video signal:

RB-SYA - The Analogue video sync board will accept a composite signal of NTSC (525), PAL (625) & SECAM (625) signals covered by SMPTE-170-M (NTSC) and ITU-R BT.470-6 (PAL & SECAM).

RB-SYD - The Digital video sync board will accept 270Mbps SD-SDI and HD-SDI signals covered by SMPTE-259-M-C (SD) and SMPTE-292M (HD).

Opening the RB-DD4

Warning: The power must be switched off at the supply or the power lead must be disconnected before attempting to open the unit. Removal of the cover can expose dangerous voltages.

1. Remove the 4 screws in the corners of the rear panel.

2. Remove the 4 screws on the top and bottom panels which hold the rear panel in place (2 on the top and 2 on the bottom).

3. Remove the screw in the centre of the front panel.

4. Slide the rear panel and main PCB backwards out of the metal chassis giving you internal access.

5. Remove the rubber grommet/bung on the rear panel which covers the hole for the video sync connector.

6. Remove the 2 screws from the bottom of the sync card pillars and, making sure to keep the plastic washers in place at the bottom of the pillars, fit the 20 way pin header into the 20 way connector on the RB-DD4 motherboard.

7. Underneath the board, insert the 2 screws to fix the board in place.

To put the unit back together, slide the PCB back into the chassis and refit the screws in reverse order.

The video synchronisation is chosen using the front panel DIPSwitches (see page 6).

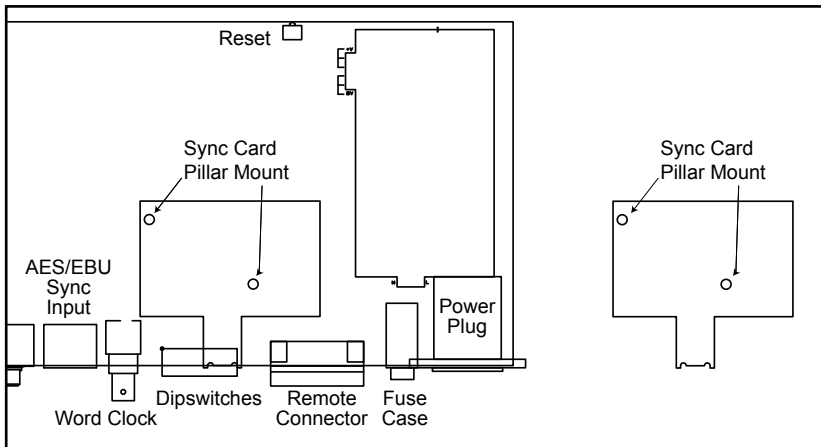Follow these instructions to fit either of the sync boards.

Fig E: RB-DD4 Optional Video Sync Installation

WEEE & RoHS Directives - Sonifex Statement

The Waste Electrical and Electronic Equipment (WEEE) Directive was agreed on 13 February 2003, along with the related Directive 2002/95/EC on Restrictions of the use of certain Hazardous Substances in electrical and electronic equipment (RoHS).

The **Waste Electrical and Electronic Equipment Directive (WEEE)** aims to minimise the impacts of electrical and electronic equipment on the environment during their life times and when they become waste. It applies to a huge spectrum of products. It encourages and sets criteria for the collection, treatment, recycling and recovery of waste electrical and electronic equipment. All products manufactured by Sonifex Ltd have the WEEE directive label placed on the case. It gives a contact for individuals who are unsure about the correct procedure when the product has reached its "end of use".

Sonifex Ltd will be happy to give you information about local organisations that can reprocess the products, or alternatively all products that have reached "end of use" can be returned to Sonifex and will be reprocessed correctly free of charge.

Sonifex Ltd has phased out the use of certain hazardous substances identified in the European Union's **Restriction of Hazardous Substances (RoHS)** directive. The RoHS directive limits the use of certain hazardous substances currently used in EEE manufacture, including lead, mercury, cadmium, hexavalent chromium, and halide-containing compounds PBB (polybrominated biphenyl) and PBDE (polybrominated diphenyl ether). Elimination of these substances will result in more environmentally friendly recycling of electronic equipment. For the products which Sonifex manufacture, the main area where products were affected was in the use of lead for manufacturing and assembling electronics circuit boards.

Sonifex Ltd practices lead-free (LF) manufacturing processes. LF solder is used on the surface-mount PCB manufacturing processes and for hand soldering. The printed circuit boards (PCBs) used are either gold plated, or immersion tin plated, both of which use no lead. Historically the PCBs were hot air solder levelled (HASL) PCBs which used tin/lead based solder.

The manufacturing processes include the assembly of purchased components from various sources. Product is offered as RoHS compliant, or LF, only after sufficient evidence is received from the component manufacturers that their components are RoHS compliant. Sonifex Ltd relies solely on the distributor, or manufacturer, of the components for identification of RoHS compliance. Thus whilst every effort is made to ensure compliance, Sonifex Ltd makes no warranty, or certification, or declaration of compliance concerning said components.

Sonifex Ltd defines "Lead Free" as pertaining to any product, which has been manufactured by Sonifex Ltd using components which have been declared by the manufacturers as "Lead Free". All statements by Sonifex Ltd of RoHS compliance are based on component manufacturer documentation.

Introduction

Fig 1-1: RB-DD4 Front Panel

The RB-DD4 4 channel digital audio delay allows you to delay 4 mono channels of audio independently or together. Each channel delay is user selectable from multiples of common video frame rates, or a user defined value set via the serial interface. The unit is perfect for synchronizing audio to video which has been delayed by processing latency.

Using a front panel button, you can select which channel needs to be delayed. There is also an 'ALL' option which allows the selected delay to be applied to all channels. Then using another front panel button you can select the length of one frame of delay and the multiple of frames to delay by.

The connectivity is incredibly flexible, allowing three different types of connection to each input and output including AES/EBU, S/PDIF and TOSLink. All three different types of output can be used simultaneously. There is a monitor socket on the front panel which allows you to listen to each mono channel, by front panel selection. Pairs of channels can be monitored (1 & 2 or 3 & 4) using a rear panel stereo option. There is also an option to attenuate the monitor by 12dB selectable by rear panel DIPswitch. Audio presence is detected and displayed for each channel around the INPUTS 1 & 2 and INPUTS 3 & 4 buttons.

The flexibility continues with many audio synchronization options. The digital audio output can be synchronized to either input, an additional AES/EBU reference input, a TTL wordclock BNC input or an analogue/SDI video feed if used with an additional RB-SYA or RB-SYD board. Also the output can be synchronized to an on-board master clock, with a selectable frame rate. There are warning indicators on the front panel for loss of lock on both inputs and for the selected external synchronization. Selectable synchronization modes are as follows:

Master Mode
In this mode the digital output sample rate is simply set by, and locked to, the internal on-board clock generator. No sync signal is used or required.

Auto Sync Mode
In this mode the digital output sample rate follows the selected sync input. When the sync signal is not present the output sample rate will be set by, and locked to, the internal on-board clock generator at the selected output frequency.

Auto Lock Mode
In this mode no output will be generated until lock is achieved with a sync signal. The digital output sample rate now follows the sync input. If the sync signal is removed then

the output sample rate will be set by, and locked to, the internal on-board clock generator at the closest frequency available to the previous sync input.

Slave Mode

In this mode the digital output sample rate follows the sync input. When the sync signal is not present the digital output is turned off.

A powerful feature of the RB-DD4 is that by using the Sonifex SCi serial software, the unit can be programmed for different delay durations, levels and switching functions so that you can program the unit for your specific application. A rear panel DIPswitch configures the unit to be controlled serially. Contact Sonifex for further information if you have a particular requirement that isn't catered for by the RB-DD4 as standard.

The RB-DD4 has been designed to have a passive signal path through the main input, so if power to the unit fails, signal inputs 1 & 2 are routed to outputs 1 & 2 and signal inputs 3 & 4 are routed to outputs 3 & 4. This is essential for applications such as installation at transmitter sites, where a power failure to the unit should not prevent the audio input signal from being output to the transmitter. Please note that this is not true for the TOSLink outputs which are muted.
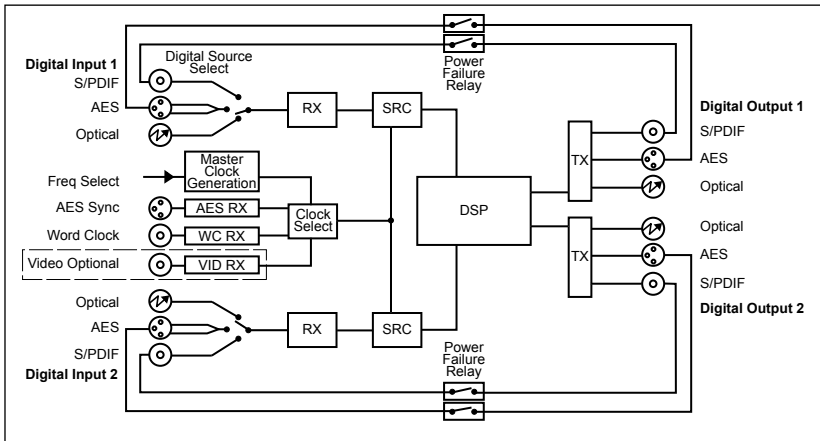
Fig 1-2: RB-DD4 Block Diagram

Front Panel Controls and Indicators

The LED in the front panel is normally red to indicate power to the unit.

DELAY Select & Indicators   INPUTS 1 & 2   MONITOR SELECT   Headphone Socket

Power LED   Reset Button   CHANNEL SELECT   INPUTS 3 & 4   Monitor Gain Pot
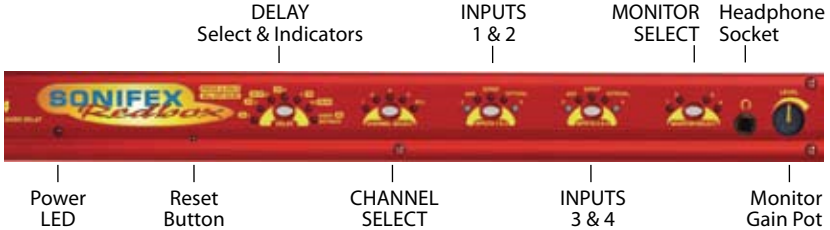
Fig 1-3: Front Panel Controls and Indicators

Fig 1-4: DELAY Button

DELAY Unit & Quantity Select and Indicators

This button allows you to select the length of a delay unit and the multiple, which when multiplied together give the total delay length.

To set the Delay Unit, press and hold the DELAY button. A single given LED is lit to indicate which unit has been selected. Pressing the button moves the selection in a clockwise direction.

To set the multiple/quantity of units to delay, press and hold the DELAY button again. The LEDS around the button indicate the chosen delay multiple and the total multiple is found by summing the indicated numbers. Pressing the button increments the multiple by one. (See pages 7 & 8 for more info on Delay Button Modes).

Fig 1-5: CHANNEL SELECT Button

Channel Select

This button selects and indicates the currently selected input channel. There is an option for each individual channel and an option for all channels. As each different channel is selected, the currently selected delay multiple for that channel is displayed on the DELAY button LEDs. Any change of the multiple or delay unit length is applied to the currently selected channel, or all of them if the ALL option is selected. Pressing the button moves the selection in a clockwise direction.

Fig 1-6: INPUTS 1 & 2 Button

INPUT 1 & 2 Source Select, Indicators & Input Presence LEDs

This button allows you to select which input source you would like to use for the selected channel. The three LEDs above the button illustrate which source is selected. The button itself is illuminated when the input is locked.

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The bicolour LEDs, marked '1' and '2', show input presence and give an indication of the input level using the AES digital standard with the following colours:

-INF < -52dBFS = OFF
-52dBFS < -3dBFS = GREEN
-3dBFS <0dBFS = ORANGE

INPUT 3 & 4 Source Select, Indicators & Input Presence LEDs
The operation of this button is identical to above.

MONITOR SELECT button
Press the MONITOR SELECT button to choose an output to monitor in the headphones. For monitor selection the button illuminates read and the LEDS around the button display in red which channel has been selected.

The button also displays external signal status. If the selected synchronisation source is unlocked, the button flashes green and red.

Fig 1-7: MONITOR SELECT Button

Headphone Output
The front panel headphone output is a ¼" (6.35mm) stereo jack socket capable of delivering over 80mW into 32Ω - 600Ω professional headphones at full volume. Higher impedance headphones may be used at reduced levels. Lower impedance headphones should not be used.

If the output sounds bad or disturbed at any time, use the monitor attenuation DIPSwitch 10 to reduce the headphone output to an acceptable level - this will depend on the impedance of the headphones that you are using.

Fig 1-8: Headphone Output & Level Controls

LEVEL Control
The front panel LEVEL control is a potentiometer that adjusts the level of the monitor output and provides a gain range of -70dB to +12dB.

Reset Button
In the unlikely event that the RB-DD4 unit fails to respond, press the reset button to reboot the unit (see Fig 1-9 for location).

Fig 1-9: Reset Button

Rear Panel DIPSwitches
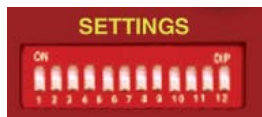
The SETTINGS DIPSwitch block on the rear panel is used to configure the RM-DD4:

Fig 1-10: RB-DD4 Rear Panel DIPSwitch Block

Master Mode Sample Rate Selection (DIPSwitches 1-3)

These DIPSwitches allow you select which sample rate the output is set to when the unit is synchronised to the Master Mode:

Sample Rate (kHz)	DIPSwitch 1	DIPSwitch 2	DIPSwitch 3
32	OFF	OFF	OFF
44.1	ON	OFF	OFF
48	OFF	ON	OFF
88.2	ON	ON	OFF
96	OFF	OFF	ON
176.4	ON	OFF	ON
192	OFF	ON	ON

Synchronisation Source Selection (DIPSwitches 4-6)

These DIPSwitches allow you select which input sync source is used to synchronise the unit:

Synchronisation Source	DIPSwitch 4	DIPSwitch 5	DIPSwitch 6
Input 1 & 2	OFF	OFF	OFF
Input 3 & 4	ON	OFF	OFF
AES/EBU Sync Input	OFF	ON	OFF
Word Clock Input	ON	ON	OFF
Video Sub Board	OFF	OFF	ON

Synchronisation Mode Selection (DIPSwitches 7-8)

These DIPSwitches allow you select the active sync mode:

Synchronisation Mode	DIPSwitch 7	DIPSwitch 8
Master Mode	OFF	OFF
Auto Sync Mode	ON	OFF
Auto Lock Mode	OFF	ON
Slave Mode	ON	ON

Stereo/Mono Operation of the Headphone Monitor (DIPSwitch 9)

This defines whether the monitor operates as a stereo pair or as mono channels 1 & 2.

Mode	DIPSwitch 9	Description
Stereo	ON	Also when ON, the headphone monitor outputs a stereo signal made up of either Input 1 & 2 or Input 3 & 4.
Mono	OFF	In Mono Mode the selected signal is sent to left and right earpieces of the headphone output.

Monitor Attenuation (DIPSwitch 10)

This defines whether the monitor signal is attenuated by 12dB. This is useful if you're using low impedance headphones which are too loud in everyday use.

Mode	DIPSwitch 10	Description
Attenuated	ON	When ON, the monitor signal is attenuated.
Unattenuated	OFF	When OFF, the monitor signal is unaffected.

Serial Mode (DIPSwitch 11)

This defines whether the unit is in serial mode. In serial mode the unit is controlled by the serial port, not by its DIPSwitch settings. For example for use with the Sonifex SCi software.

Mode	DIPSwitch 11	Description
Serial Control	ON	When ON, the unit is in serial mode.
DIPSwitch Control	OFF	When OFF, the unit is in normal operation.

Boot Mode (DIPSwitch 12)

With this DIPSwitch ON, the unit powers up into 'Boot Mode'. In this mode, the firmware in the unit can be upgraded using the SCi software. Note that this would be useful if a firmware update to the unit was interrupted, or corrupted which left the unit in an inoperable condition.

Mode	DIPSwitch 12	Description
Boot Mode	ON	When ON, the unit is in Boot Mode.
Normal Operation	OFF	When OFF, the unit is operates normally.

Delay Button Modes

The Delay button operates in two different modes:

Delay Unit Select Mode

To select the delay unit press and hold the delay button for two seconds and then release. The button turns green. Momentary pressing of the button moves the Delay Unit selection in a clockwise direction. There are eight different options for the delay unit with each number corresponding to a frame per second value with the delay unit length being the reciprocal of this value. The available choices (in frames per second) are:

23.98
24
25
29.97
30
50
59.94
60

Once the delay unit length has been chosen, press and hold the button for two seconds to return to Delay Multiple mode.

Delay Multiple Mode

This is the default mode for this button and is used to select the quantity, or multiple, of units to delay by. Press this button to increment the multiple value from 1 unit to 19. The quantity is displayed as the sum of the LEDS around the button. The following explains how the LEDs display the number:

	Led Number						
Multiple	**1**	**2**	**3**	**4**	**5**	**10**	**U D**
Minimum	**Off**	**Off**	**Off**	**Off**	**Off**	**Off**	**Off**
1	On	Off	Off	Off	Off	Off	Off
2	Off	On	Off	Off	Off	Off	Off
3	Off	Off	On	Off	Off	Off	Off
4	Off	Off	Off	On	Off	Off	Off
5	Off	Off	Off	Off	On	Off	Off
6	On	Off	Off	Off	On	Off	Off
7	Off	On	Off	Off	On	Off	Off
8	Off	Off	On	Off	On	Off	Off
9	Off	Off	Off	On	On	Off	Off
10	Off	Off	Off	Off	Off	On	Off
11	On	Off	Off	Off	Off	On	Off
12	Off	On	Off	Off	Off	On	Off
13	Off	Off	On	Off	Off	On	Off
14	Off	Off	Off	On	Off	On	Off
15	Off	Off	Off	Off	On	On	Off
16	On	Off	Off	Off	On	On	Off
17	Off	On	Off	Off	On	On	Off
18	Off	Off	On	Off	On	On	Off
19	Off	Off	Off	On	On	On	Off
User Defined	Off	Off	Off	Off	Off	Off	On

When all the LEDs are OFF, the channel uses the minimum delay which is dependant on the input sample and output sample rates.

		Input Samplerate (Hz)						
		32k	**44.1k**	**48k**	**88.2k**	**96k**	**176.4k**	**192k**
Output Samplerate (Hz)	**32k**	4.594 msec	3.680 msec	3.484 msec	2.472 msec	2.374 msec	1.869 msec	1.819 msec
	44.1k	4.247 msec	3.333 msec	3.137 msec	2.125 msec	2.027 msec	1.522 msec	1.473 msec
	48k	4.172 msec	3.259 msec	3.063 msec	2.051 msec	1.953 msec	1.447 msec	1.398 msec
	88.2k	3.788 msec	2.875 msec	2.678 msec	1.667 msec	1.569 msec	1.063 msec	1.014 msec
	96k	3.751 msec	2.837 msec	2.641 msec	1.629 msec	1.531 msec	1.025 msec	0.976 msec
	176.4k	3.559 msec	2.645 msec	2.449 msec	1.437 msec	1.339 msec	0.833 msec	0.784 msec
	192k	3.540 msec	2.626 msec	2.430 msec	1.419 msec	1.320 msec	0.815 msec	0.766 msec

Fig 1-11: Minimum delay values (at 0 frames) due to inherent delay at different input to output sample rates within the unit, measured in ms
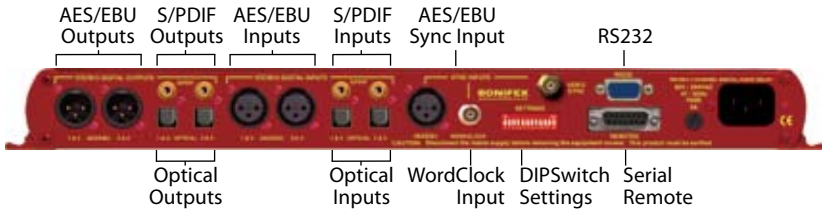
Fig 1-12: RB-DD4 Rear Panel

RB-DD4 Inputs

AES/EBU Inputs

The digital input XLR 3 pin socket has an impedance of 110Ω. It has the following connections:

Pin 1: Screen
Pin 2: Phase
Pin 3: Non-phase

The signals on this connector should meet the IEC 60968 specification

S/PDIF Inputs

The S/PDIF digital phono input have an impedance of 75Ω.

Optical Inputs

The digital audio optical input meets the TOSLink specification used by most professional & consumer equipment.

AES/EBU Sync Input

The digital input XLR 3 pin socket has an impedance of 110Ω. It has the following connections:

Pin 1: Screen
Pin 2: Phase
Pin 3: Non-phase

The signals on this connector should meet the IEC 60968 specification

Word Clock Input

The wordclock TTL BNC input has an impedance of 75Ω.

INTRODUCTION

Video Sync Input

The optional video sync input is presented as a 75Ω BNC connector. See page vi for more information on the video sync boards available.

Serial RS232 Connector

The 9-way 'D' type socket connector carries a standard RS232 interface and allows direct connection to a serial port on a PC via a pin-to-pin cable. The pin assignments are as follows:

Pin 2: Transmit data
Pin 3: Receive data
Pin 5: Ground
All other pins are unused.

Remotes Connector

The remotes connector is a 15-way 'D' type socket that is currently reserved for future development. Displayed below are the pin connections and a description of what is available:

Pin 1 – Relay 1 Normally Open
Pin 2 – Relay 1 Normally Closed
Pin 3 – Relay 2 Normally Open
Pin 4 – Relay 2 Normally Closed
Pin 5 – Make to Digital Ground Input
Pin 6 – Internal Open Collector to Digital Ground Output
Pin 7 – Make to Digital Ground Input
Pin 8 – Digital Ground
Pin 9 – Relay 1 Common
Pin 10 – Make to Digital Ground Input
Pin 11 – Relay 2 Common
Pin 12 – 5 V Supply Maximum 200 mA
Pin 13 – Internal Open Collector to Digital Ground Output
Pin 14 – Make to Digital Ground Input
Pin 15 – Internal Open Collector to Digital Ground Output

RB-DD4 Outputs

AES/EBU Outputs

The digital output XLR 3 pin socket has an impedance of 110Ω. It has the following connections:

Pin 1: Screen.
Pin 2: Phase.
Pin 3: Non-phase.

The signals on this connector will comply with the IEC 60968 specification

S/PDIF Outputs

The digital output S/PDIF phono output has an impedance of 75Ω.

Optical Outputs

The digital audio optical output meets the TOSLink specification used by most professional & consumer equipment.

The outputs have an unweighted dynamic range of at least 138dB and a THD+N noise of or better than –137dB. The data at the outputs is presented as 24 bit wide.

INTRODUCTION

Serial Port Control

The Serial Port allows the RB-DD4 to be controlled and updated from a PC via a pin-to-pin serial cable, using the Sonifex Serial Control Interface (SCI) software. This software is available as a free download from the Sonifex website at www.sonifex.co.uk/sci.

Default Settings for the Serial Port	
Baud Rate:	19200
Data Bits:	8
Stop Bits:	1
Parity:	Even
Handshaking:	XON/XOFF

Fig 2-1: Serial Port Default Settings

Serial Interface Commands and Responses

Most of the commands follow the same structure: a 3 letter command followed by a colon, followed by a parameter (if any) and terminated by Carriage Return with optional Line Feed. A Line Feed character may be sent but it will be ignored by the RB-DD4. Commands are not case sensitive.

Responses are CR & LF terminated.

After the RB-DD4 has been powered-up, an initialisation string is sent

"Initialising DD4".

Following are the commands and the expected responses:

Command	Description	Response
Bnn:	Baudrate Change nn is the new baudrate value where: nn = 11 = 115200kbps nn = 57 = 57600kbps nn = 38 = 38400kbps nn = 19 = 19200kbps nn = 96 = 9600kbps	-ACK:
CHN:nn	Channel Select Where nn represents the channel which is selected where: 00 = Input 1 01 = Input 2 02 = Input 3 03 = Input 4 04 = All Inputs	-ACK:
DLY:	Delay Setup a_b_cc_dddddd a: Channel to apply delay to where 0 = Input 1 1 = Input 2 2 = Input 3 3 = Input4 4 = All Inputs b: Chosen delay Unit where 0 = Samples 1 = Milliseconds 2 = Fields 3 = Frames 4 = Lines cc: Choose video standard where 00 = 625/29.97i 01 = 525/25i 02 = 720/60p 03 = 720/59.94p 04 = 720/50p 05 = 720/30p 06 = 720/29.97p 07 = 720/25p 08 = 720/24p	-ACK:

Command	Description	Response
	09 = 720/23.98p	
	0A = 1035/60i	
	0B = 1035/59.94i	
	0C = 1080/60i	
	0D = 1080/59.94i	
	0E = 1080/50i	
	0F = 1080/30p	
	10 = 1080/29.97p	
	11 = 1080/25p	
	12 = 1080/24p	
	13 = 1080/23.98p	
	14 = 1080/30pSF	
	15 = 1080/29.97pSF	
	16 = 1080/25pSF	
	17 = 1080/24pSF	
	18 = 1080/23.98pSF	
	19 = 1080/60p	
	1A = 1080/59.94p	
	1B = 1080/50p	
	dddddd: Number of samples in hex	
DWN:	Download firmware Initiates a firmware upgrade	-ACK:
FPS:	Front panel and unit status	

-FPS:aa_bb_cc_dd_ee_ff_gg_hh_ii_jj_kkkkkk_llllll_mmmmmm_nnnnnn_oooooo

aa: Input 1 & 2 source selection
bb: Input 3 & 4 source selection
where 00 = AES, 01 = SPDIF,02 = TOSLINK
cc: Sync mode selection
where 00 = Master, 01 = Auto, 02 = Auto lock, 03 = Slave mode
dd: Serial Flag indication
where 00: Serial Mode Off, 01 = Serial mode On
ee: Frequency
where 00 = 32k,01 = 44.1k,02 = 48k,03 = 88.2k,04 = 96k,05 = 176.4k,06 = 192k
ff: Monitor Channel
where 00 = OUTPUT1,01 = OUTPUT2, 02 = OUTPUT3, 03 = OUTPUT4
gg: Sync From
where 00 = Input 1, 01 = Input 2, 02 = AES Sync, 03 = Word Clock, 04 = Video Sync

Command	Description	Response
	hh: Rear dip switch settings	

where hh is a hex value built from the sum of all
applicable from:

01: Stereo Monitor
02: Monitor Attenuation

ii: Current video standard and delay unit
where ii is a hex value built from the sum of:
If in standard mode, Interval

60 = 23.98
61 = 24.0
62 = 25.0
63 = 29.97
64 = 30.0
65 = 50.0
66 = 59.94
67 = 60.0

If in Serial Mode, Video standard

00 = 625/29.97i
01 = 525/25i
02 = 720/60p
03 = 720/59.94p
04 = 720/50p
05 = 720/30p
06 = 720/29.97p
07 = 720/25p
08 = 720/24p
09 = 720/23.98p
0A = 1035/60i
0B = 1035/59.94i
0C = 1080/60i
0D = 1080/59.94i
0E = 1080/50i
0F = 1080/30p
10 = 1080/29.97p
11 = 1080/25p
12 = 1080/24p
13 = 1080/23.98p

Command	Description	Response
	14 = 1080/30pSF	
	15 = 1080/29.97pSF	
	16 = 1080/25pSF	
	17 = 1080/24pSF	
	18 = 1080/23.98pSF	
	19 = 1080/60p	
	1A = 1080/59.94p	
	1B = 1080/50p	
	Delay unit	
	00 = Samples	
	20 = Milliseconds	
	40 = Fields	
	60 = Frames	
	80 = Lines	
	jj: Current channel	
	where 00 = Input1, 01 = Input 2, 02 = Input 3, 03 = Input 4	
	and 04 = All inputs	
	kkkkkk: Current delay on Input1	
	where kkkkkk is the number of samples in hex. If most significant bit is set, User Defined mode is selected.	
	llllll: Current delay on Input2	
	where llllll is the number of samples in hex. If most significant bit is set, User Defined mode is selected.	
	mmmmmm: Current delay on Input3	
	where mmmmmm is the number of samples in hex. If most significant bit is set, User Defined mode is selected	
	nnnnnn: Current delay on Input4	
	where nnnnnn is the number of samples in hex. If most significant bit is set, User Defined mode is selected.	
	oooooo: Current all input delay	
	where oooooo is the number of samples in hex. If most significant bit is set, User Defined mode is selected.	
FRQ:nn	Output samplerate selection	-ACK:
	nn selects which samplerate is selected for the output where:	
	00 = 32k	
	01 = 44.1k	
	02 = 48k	
	03 = 88.2k	
	04 = 96k	
	05 = 176.4k	
	06 = 192k	

Command	Description	Response
MAT:nn	Monitor attenuation nn selects between the two modes 00 = No attenuation 01 = 12 dB of attenuation	-ACK:
MOD:nn	Sync mode selection nn selects the synchronization mode where: 00 = Master mode 01 = Auto mode 02 = Auto Lock mode 03 = Slave	-ACK:
MON:nn	Select Monitor Channel nn selects which channel is monitored where 00 = Output 1 01 = Output 2 02 = Output 3 03 = Output 4	-ACK:
MOS:nn	Mono or stereo selection nn selects between the two options where: 00 = Mono mode 01 = Stereo mode	-ACK:
SRQ: Status Request		-SRQ:aa_bb_cc_dd_eeee_ffff

aa: Input1 Lock status

bb: Input2 Lock status

where 01 = locked and 00 = unlocked

cc: Sync Flash

where 01 = Flashing and 00 = Not flashing

dd: Presence

where dd is a hex value built from the sum of:

01 = Green On Input 1

02 = Green On Input 2

04 = Green On Input 3

08 = Green On Input 4

10 = Red On Input 1

20 = Red On Input 2

40 = Red On Input 3

80 = Red On Input 4

Command	Description	Response
SSx:nn	Source select x selects which input is being changed where: 1 = Input 1 & 2 2 = Input 3 & 4 nn selects which source is used for that particular input where: 00 = AES 01 = SPDIF 02 = Optical	-ACK:
SYS:nn	Sync source select nn selects which sync source is used where: 00 = Input 1 & 2 01 = Input 3 & 4 02 = AES 03 = Wordlock 04 = Video	-ACK:
UID:	Unit id	-UID:RB-DD4
VER:	Version number Where x.xxx is the firmware version and y.yyy id the front panel firmware version number	-VER:x.xxx,y.yyy

Error Messages

The following error messages can be returned for illegal commands

Err:01-Return if command not found

Err:02-Return if missing parameter

Err:04-Return if parameter out of range

SCi for the RB-DD4

SCi allows the user to control the RB-DD4 remotely. The interface has three tabs including a Status page, a Unit Setup page and a Miscellaneous option page. The status of the connection, serial number and firmware versions are always visible at the bottom of the interface.
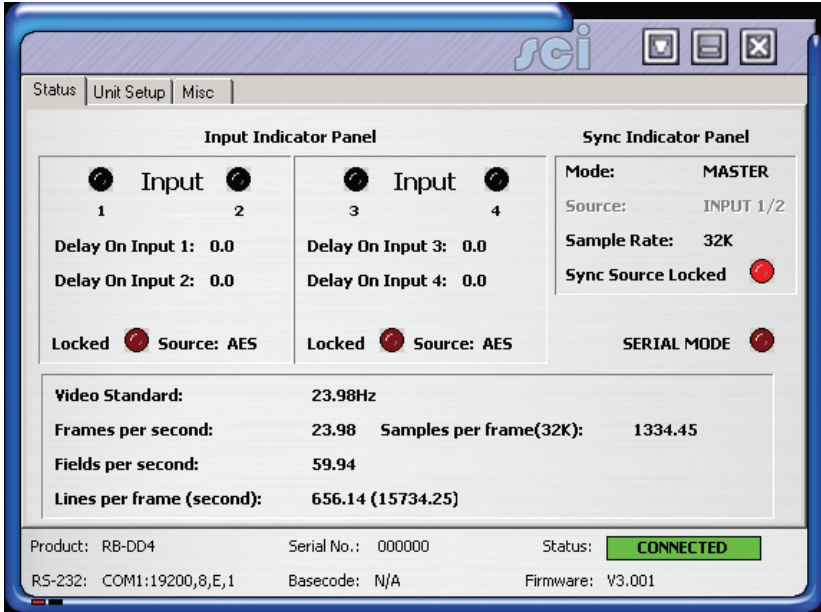
Status Page

Fig 3-1: Status Page

This page displays the current status of the unit. Each set of inputs has an indicator panel which displays:

Presence Level: The current audio status is displayed as it is on the front panel. (Please refer to page 3).

Delay on Input Labels: Displays the delay applied to each input channel

Locked LED: If the input is locked, this LED is lit.

Source Label: The source which is currently being used is displayed here.

Synchronization options are displayed in the sync indicator panel:

Mode: This displays the selected sync mode.

Source: This displays the selected sync source. This is disabled in Master mode.

Sample Rate: This displays the current output sample rate.

Sync Source Locked Led: If the synchronization source is locked this led will be lit.

SCi FOR RB-DD4

The serial mode LED indicates whether the unit is in serial mode.
All the current delay information is displayed in lower panel.

Unit Setup Page

Fig 3-2 Unit Setup Page

The control page is where the user will set up their unit. For ease of use, the options have been split into four sections which the user visits in numbered steps:

1. Select Input Sources
Select which source you would like to use for both the Input 1 and input 2 from the drop down boxes labelled "INPUT 1/2 is" and "INPUT 3/4 is" respectively.

2. Select Synchronization Options
Select which sync mode to use from the first drop down box, labelled "Sync mode is". If "MASTER" is chosen, then simply select your output sample rate from the drop down box labelled "where sample rate is". If "AUTO", "AUTOLOCK" or "SLAVE" are selected, then a new drop down box labelled "from" will appear which allows the user to select the synchronization source.

3. Delay Setup
Select all appropriate options from the drop down boxes and then type the delay value you require in the Delay edit box. Press the "Apply" to confirm this delay. Please note that

changing the frame rate can affect the total allowed delay. The memory usage bar indicates how much of the allotted memory has been used for each channel. The maximum delay achievable is 8 seconds per channel at 32kHz.

4. Select Special Options

Select which output is monitored by using the drop down box labelled "Monitor output is".

There are two tick options that can be selected. Select each one by clicking on the check box so that it displays a tick. The options are:

•   Stereo features enabled
•   Attenuate monitor output by 12dB

If serial mode is selected, all the controls are enabled. The controls are disabled if serial mode is switched off.
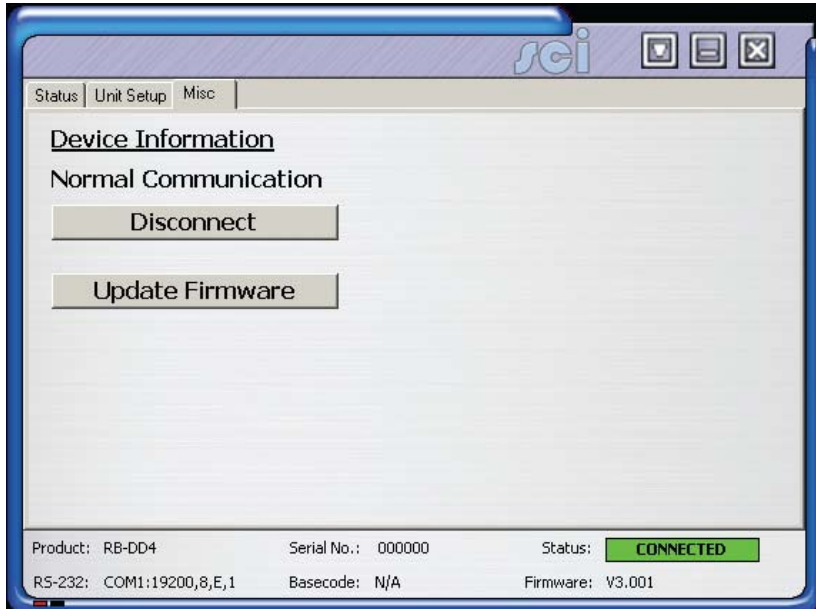
Miscellaneous Page

Fig 3-3 Miscellaneous Page

This page is used for the connecting and disconnecting SCi to the unit and updating the firmware. Any special modes are also selected from here.

Updating the Firmware

The RB-DD4 firmware will at times be updated to add new features or correct any possible issues that may arise. Check for updates at:

http://www.sonifex.co.uk/technical/software/

To update the firmware click on the button labeled "Update Firmware" and then select the downloaded firmware file. Firmware files for the RB-DD4 always have an ".dwn" extension. A progress bar appears in SCi, indicating how much of the file has been uploaded to the unit.

When the unit switches to update mode, the front panel display LEDs are all extinguished. The left program LED is then used to display the status of the upload:

Uploading The Code: The LED begins to flash amber to confirm the unit is receiving the new firmware to RAM.

Copying Code To Flash Memory: The LED is solid amber while the unit checks the integrity of the file and copies the file from RAM to flash.

Successful Update: The LED turns green for two seconds and the unit automatically resets and begins to run the new code.

Unsuccessful Update: The LED turns red for two seconds and the unit returns to running the last code.

Technical Specification For RB-DD4

Audio Specification

Dynamic Range:	>138dB
Distortion and Noise:	<-137dB THD + N at 1kHz, ref 0dB FS
Input & Output Impedances:	110Ω ±20% AES/EBU balanced I/O 75Ω ±5% S/PDIF unbalanced I/O 75Ω ±5% TOSlink unbalanced I/O 50Ω BNC TTL word clock input
Signal Level:	Balanced: 3V/10V peak to peak min/max Unbalanced: Min 0.5V±20% peak to peak
Sample Frequencies:	32, 44.1, 48, 88.2, 96,176.4 or 192kHz
Bit Depth:	Up to and including 24 bit

Front Panel Operational Controls & Indicators

Digital Input Select:	AES/EBU, S/PDIF or TOSlink optical via INPUTS 1 & 2 or INPUTS 3 & 4 push-buttons
Delay Control:	Delay time selection system via front panel push button
Monitor Volume Control Range:	-70dB to +12dB gain
Indicators:	Input presence indicators via bicolour LEDS around each push button

Rear Panel Operational Controls

Master Select:	32, 44.1, 48, 88.2, 96,176.4 or 192kHz frequency via rear panel DIPSwitches
Sync Source Select:	INPUTS 1 & 2, INPUTS 3 & 4, AES Sync, Word Clock or optional Video Sync Board

Video Sync via rear panel DIP switches

Sync Mode Select:	Master, Auto Sync, Auto Lock, Slave via rear panel DIPSwitches
Stereo Features:	Stereo monitor outputs via rear panel DIPSwitches

TECHNICAL SPECIFICATION

TECHNICAL SPECIFICATION

Monitor Attenuation:	12dB Monitor attenuation via rear panel DIPSwitches
Serial Mode:	Enter serial control mode via rear panel DIPSwitches
Boot Mode:	Boot up base code or firmware via rear panel DIPSwitches
Connections	
Digital Inputs:	2 x AES/EBU XLR 3 pin female 2 x S/PDIF RCA phono 2 x TOSLink optical input
Digital Outputs:	2 x AES/EBU XLR 3 pin plug 2 x S/PDIF RCA phono socket 2 x TOSLink optical output
Sync Inputs:	1 x AES/EBU XLR 3 pin female 1 x Word Clock BNC 1 x Video Input (optional)
Remote I/O Port:	15 way D-type socket
Serial Port:	RS232, 9 Way D-Type socket
Mains Input:	Universal filtered IEC, continuously rated 85-264VAC@47- 63Hz, max 10W
Fuse Rating:	Anti-surge fuse 2A 20 x 5mm
Equipment Type	
RB-DD4:	4 Channel Digital Audio Delay Synchroniser
Physical Specifications	
Dimensions (Raw):	48cm (W) x 10.8cm (D*) x 4.2cm (H) (1U) 19" (W) x 4.3" (D*) x 1.7" (H) (1U)
Dimensions (Boxed):	53cm (W) x 25.5cm (D) x 6cm (H) 21" (W) x 10" (D) x 2.4" (H)
Weight:	Nett: 1.4kg Gross: 2.0kg Nett: 3.1lb Gross: 4.4lb
Accessories	
RB-SYA:	Analogue video sync board (NTSC, PAL & SECAM)
RB-SYD:	Digital video sync board (SD-SDI & HD-SDI)
RB-RK3:	1U Rear panel rack kit for large Redboxes

* Note that this product is deeper than standard Redboxes

SONIFEX

www.sonifex.co.uk

t:+44 (0)1933 650 700
f:+44 (0)1933 650 726
sales@sonifex.co.uk